

WHAT IS CLAIMED IS:

1. A rolling bearing with sensor, comprising:  
an inner ring;  
an outer ring;

5 a plurality of rolling elements disposed between said inner and outer rings; and  
a sensor having a detecting part detecting a state of said rolling bearing and a circuit part connected to said detecting part,

10 wherein said detecting part and said circuit part are attached to said rolling bearing.

2. The rolling bearing with sensor according to claim 1, wherein said sensor detects at least one of a rotating speed,  
15 a vibration, a temperature and a humidity.

3. The rolling bearing with sensor according to claim 2, wherein at least one of said detecting part and said circuit part is attached to at least one of said inner and outer rings  
20 along a circumferential direction thereof.

4. The rolling bearing with sensor according to claim 2, wherein at least one of said detecting part and said circuit part is attached to an end face of at least one of said inner  
25 and outer rings.

5. The rolling bearing with sensor according to claim 4, further comprising:

a cover attached to said one of said inner and outer rings having said detecting part, for covering said detecting part.

6. The rolling bearing with sensor according to claim 1, further comprising:

a printed circuit board mounting said detecting part and said circuit part, said printed circuit board being attached to a surface of at least one of said inner and outer rings.

7. The rolling bearing with sensor according to claim 3, wherein said outer rings is formed with an annular groove for mounting said printed circuit board so that said printed circuit board is disposed inside of a prolongation of an end face of said outer ring and inside of a prolongation of an outer peripheral surface of said outer ring.

8. The rolling bearing with sensor according to claim 3, wherein said inner ring is formed with an annular groove for mounting said printed circuit board so that said printed circuit board is disposed inside of a prolongation of an end face of said inner ring and outside of a prolongation of an inner peripheral surface of said inner ring.

9. The rolling bearing with sensor according to claim

1, wherein said detecting part is attached to a recessed part formed by cutting a part of an end face of at least one of said outer and inner rings.

5           10.    The rolling bearing with sensor according to claim 1, wherein at least one of said detecting part and said circuit part is molded by an insulating material.

10           11.    The rolling bearing with sensor according to claim 1, wherein further comprising:

          a shield for protecting rolling surfaces of said inner and outer rings and said rolling elements; and

          a printed circuit board mounting said detecting part and said circuit part, said printed circuit board being attached

15 to said shield.

          12.    The rolling bearing with sensor according to claim 1, further comprising:

20           a shield for protecting rolling surfaces of said inner and outer rings and said rolling elements; and

          a detecting part detecting a humidity and being located within a space surrounded by said inner and outer rings and said shield supported to one of said inner and outer rings.

25           13.    The rolling bearing with sensor according to claim 2, wherein said detecting part for detecting the vibration

includes a detector utilizing a micro mechanism with a movable part and a fixed part, and a vibration detecting value of said detector is set by changing an elastic modulus of said movable part.

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14. The rolling bearing with sensor according to claim 1, further comprising:

a surface-opposed electric generator having a coil provided on one of said inner and outer rings and a magnet provided on the other.

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15. The rolling bearing with sensor according to claim 1, wherein said circuit part includes a transmitting part converting a signal detected by said detecting part into a radio wave and transmitting said radio wave.

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16. The rolling bearing with sensor according to claim 15, wherein an oscillation frequency generated by said transmitting part is selectively detectable.

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17. The rolling bearing with sensor according to claim 1, wherein said circuit part includes an ultrasonic wave generating part converting a signal detected by said detecting part into an ultrasonic wave, and transmitting the converted ultrasonic wave.

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18. A rolling bearing with sensor, comprising;

an inner ring;

an outer ring;

a plurality of rolling elements disposed between said

5 inner and outer rings;

a retainer for retaining said rolling elements;

a sensor having a detecting part detecting at least one  
of a rotating speed, a vibration, a temperature and a humidity,

a transmitting part transmitting an output of said detecting

10 part or a signal obtained by processing said output, a control

part controlling said transmitting part based on the output

of said detecting part, and a power source for supplying a power

to said detecting part, said transmitting part and said control

part; and

15 a receiving device disposed apart from said transmitting

part attached to said rolling bearing, for receiving said output

or said signal transmitted from said transmitting part.

19. The rolling bearing with sensor according to claim

20 18, wherein said detecting part, said transmitting part and

said control part are disposed on one of said inner and outer

rings, and

said power source is disposed on a member for fixing said

one of said inner and outer rings.

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20. The rolling bearing with sensor according to claim

18, further comprising:

a shield for protecting a rolling surface of said inner and outer rings and said rolling elements,

wherein said detecting part, said transmitting part and  
5 said control part are disposed on said shield, and said power source is disposed on one of inner and outer rings supporting said shield.

21. The rolling bearing with sensor according to claim  
10 18, wherein said detecting part, said transmitting part, said control part and said power source are disposed on one of said inner and outer rings.

22. The rolling bearing with sensor according to claim  
15 18, further comprising:

a shield for protecting a rolling surface of said inner and outer rings and said rolling elements,

wherein said detecting part, said transmitting part, said control part and said power source are mounted on a printed  
20 circuit board to form a sensor unit, and

said sensor unit is disposed on one of said shield, said inner ring and said outer ring, or both of said shield and one of said inner and outer rings.

23. The rolling bearing with sensor according to claim  
25 18, further comprising:

a shield supported on one of said inner and outer rings, for protecting a rolling surface of said inner and outer rings and said rolling elements, said shield including said detecting part, said transmitting part, said control part and said power source attached thereto; and

a protecting cover attached to said shield, for covering said transmitting part, said control part and said power source.

24. The rolling bearing with sensor according to claim 18, further comprising:

a ring secured to one of said inner and outer rings, for mounting said detecting part, said transmitting part, said control part and said power source.

25. The rolling bearing with sensor according to claim 18, wherein said transmitting part transmits a constant signal at predetermined intervals, and said receiving device receives said constant signal, for confirming that said sensor including said detecting part, said transmitting part and said control part are functioned normally.

26. The rolling bearing with sensor according to claim 25, wherein said transmitting part transmits different kinds of identification information including the signal transmitting when said detecting part detects an abnormal operation and the signal transmitting at said predetermined

intervals when said sensor is normally operated.

27. The rolling bearing with sensor according to claim 25, wherein said power source supplies the power to said transmitting part when said transmitting part transmits the radio wave.

28. A rolling bearing with sensor comprising:  
a plurality of rolling elements;  
first and second rings rotating relative to each other via said rolling elements; and  
an electric generator having an annular magnet disposed on said first ring and an annular conductor disposed on said second ring, said electric generator generating an electric power by the relative rotation between said first and second rings.

29. The rolling bearing with sensor according to claim 28, further comprising:  
a sensor detecting a rotating speed of said bearing based on an output of the electric power of said electric generator.

30. The rolling bearing with sensor according to claim 28, wherein said annular magnet has N and S poles which are alternately arranged in a circumferential direction of said bearing,



said annular magnet rotates relative to said annular conductor to generate an electromotive force, and

wherein said bearing further comprises a sensor detecting a relative rotating speed of said first and second rings based on an output of said electromotive force generated by said electric generator.

31. The rolling bearing with sensor according to claim 28, wherein said magnet is annularly formed so that N and S poles are alternately magnetized along the circumferential direction thereof at equal intervals.

32. The rolling bearing with sensor according to claim 28, wherein said conductor is annularly formed to extend along said magnet while being meandered.

33. The rolling bearing with sensor according to claim 28, wherein said conductor extends along said magnet while being meandered in the radial direction of said bearing.

34. The rolling bearing with sensor according to claim 28, wherein said conductor extends along said magnet while being meandered in the axial direction of said bearing on a cylindrical surface developed about a rotational axis of said bearing.

35. The rolling bearing with sensor according to claim

28; wherein said conductor is meandered at pitches equal to that of an arrangement of said magnetic poles of said magnet.

36. The rolling bearing with sensor according to claim  
5 28, wherein said conductor is rectangularly meandered.

37. The rolling bearing with sensor according to claim  
28, wherein said magnet is mounted on a first shield provided  
on said first ring, and said conductor is mounted on a second  
shield provided on said second ring.

38. The rolling bearing with sensor according to claim  
37, wherein said first shield is made of a magnetic material,  
and said second shield is made of a non-magnetic material.

39. The rolling bearing with sensor according to claim  
37, wherein a third shield made of a magnetic material is provided  
at a position opposite to said first shield, with said second  
shield being interposed therebetween.

40. The rolling bearing with sensor according to claim  
28, further comprising:

a seal for providing a closed space between said inner  
and outer rings,

wherein said magnet and said conductor of said electric  
generator is disposed on said outside of said seal forming said

closed space.

41. The rolling bearing with sensor according to claim 28, further comprising:

5 a shield for providing a closed space between said inner and outer rings,

wherein said magnet and said conductor of said electric generator is disposed on said outside of said shield forming said closed space.

10 42. The rolling bearing with sensor according to claim 29, wherein said sensor includes a detecting part further detecting at least one of a vibration, a temperature and a humidity.

15 43. The rolling bearing with sensor according to claim 29, wherein said sensor includes a transmitting part wirelessly transmitting a detecting signal.

20 44. The bearing with sensor according to claim 29, further comprising:

a storage battery which charges and discharges an electromotive force generated when said magnet and said conductor rotate relative to each other.

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45. A ring with sensor for a rolling bearing in which

a pair of raceway rings rotate relative to each other through rolling elements disposed therebetween,

wherein said ring with sensor is disposed so as to rotate together with one of said raceway rings, and

5 wherein said ring with sensor comprises:

a detecting part detecting at least one of a rotating speed, a vibration, a temperature and a humidity;

a transmitting part transmitting an output of said detecting part or a signal obtained by processing the output;

10 a control part controlling said transmitting part based on the output of said detecting part; and

15 a power source for supplying a power to said detecting part, said transmitting part and said control part.

46. The ring with sensor according to claim 45, wherein said transmitting part transmits a constant signal at predetermined intervals, and said constant signal is received by a receiving device disposed apart from said transmitting part, for confirming that said detecting part, said transmitting part and said control part are functioned normally.